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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/517,835	12/15/2004	Trond Eidsnes	5060-0101PUS1	1828

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BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER	
KAFIMOSAVI, HOSEIN	

ART UNIT	PAPER NUMBER
4132	

NOTIFICATION DATE	DELIVERY MODE
05/01/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No.	Applicant(s)	
	10/517,835	EIDSNES ET AL.	
	Examiner	**Art Unit**	
	HOSEIN KAFIMOSAVI	4132	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *Preliminary Amednment 12/15/2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/15/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 discloses an “actuator" (line 1) while disclosing the structural limitation of a “microfluidic system” (line 1). For the purpose of examination, the examiner has limited the claimed invention to the structural limitations of the “microfluidic system” and not the actuator. The same grounds apply to claims 2-31.

The parenthetical phrase “i.e.” in claim 1 (line 9) and 2 (line 15) renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d). The same grounds apply to claims 2-31.

Claims 27-31 provides for the use of actuator, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced.

Claim 27-31 is rejected under 35 U.S.C. 101 because the claimed recitation of a use, without setting forth any steps involved in the process, results in an improper definition of a process, i.e., results in a claim which is not a proper process claim under

35 U.S.C. 101. See for example *Ex parte Dunki*, 153 USPQ 678 (Bd.App. 1967) and *Clinical Products, Ltd.* v. *Brenner*, 255 F. Supp. 131, 149 USPQ 475 (D.D.C. 1966).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 3-9, 10, 12-21, 23-31 are rejected under 35 U.S.C. 102(b) as being anticipated by Squires et al (2001).

As to claim 1, Squire discloses a microfluidic system comprising a substrate consisting of at least one microchannel (Fig. 14; Pg. 9, 2nd paragraph), and an electrical connection mean for application of an electric field (U) across a segment of said microchannel (Fig. 14, Pg. 9, 2nd paragraph), characterized in that said segment comprises conducting means (Fig. 14, Pg. 9, 2nd paragraph) wherein a surface portion of conducting means is inclined with respect to the electrical field, and the space between the different conducting means, and between the conducting means and the channel walls are both 0 a_{char} (while a_{char} is interpreted as between 0.05um – 2.5mm for the purpose of examination) thus 0 x a_{char} = 0 um/mm (Fig. 14, Pg. 9, 2nd paragraph), and the surface of the conducting means is smooth (metal surface) (Pg. 9, 1st Paragraph).

As to claim 3, Squire discloses a microfluidic system above, wherein the conducting means has the shape of cylinders (Squire at Pg. 3, 2nd paragraph).

As to claim 4, Squire discloses a microfluidic system above, wherein the conducting means consists of small cylinders with the longitudinal axis normal with respect to the fluid direction (Squire at Fig. 1 &2; Pg. 3, 2nd paragraph)

As to claim 5, Squire discloses a microfluidic system above, wherein the conducting means has the shape of particles with planes which are inclined with respect to the imposed electric field (Squire at Fig. 12).

As to claim 6, Squire discloses a microfluidic system above, wherein the particles constituting the conducting means have a size of 2um, measured in parallel to the externally imposed electric field (Squire at Fig. 1; a = 1um).

As to claim 7, Squire discloses a microfluidic system above, wherein the angle λ between the inclined surface portion and the microchannel walls is 0 degrees (Squire at Fig 7).

As to claim 9, Squire discloses a microfluidic system above wherein the conducting means contains several layers of conducting particles, both axially and longitudinally in relation to the flow direction (Squire at Fig. 13).

As to claim 10, Squire discloses a microfluidic system above wherein the conducting means consist of electron conducting material (Squire at Pg. 3, 1st paragraph).

As to claim 12, Squire discloses a microfluidic system above wherein the electrical connection means contains a pair of electrodes arranged upstream or downstream with respect to the microchannel segment (Squire at Fig. 7).

As to claim 13, Squire discloses a microfluidic system above wherein the electrical connection means is adapted to provide an electrical field (u) parallel to the direction of transported field (Squire at Fig. 9).

As to claims 14 – 20 and 25, Squire discloses a microfluidic system above wherein the electrical connection means applies an alternating field (Squire at Pg.5, 1st Paragraph). The remaining claim language is functional and it is the examiner's position that the microfluidic system of Squire in view of Takahashi meets the structural limitations and would be capable of performing the claimed functions.

As to claim 21, Squire discloses a microfluidic system above wherein the electrical connection means applies a direct electric field (DC) (Squire at Pg3. 1st Paragraph).

As to claim 23, Squire discloses a microfluidic system above wherein electrical connection means contains four electrodes (Squire at Fig. 10). The remaining claim language is functional and it is the examiner's position that the microfluidic system of Squire meets the structural limitations in would be capable of performing the claimed functions.

As to claim 24, Squire in view of Takahashi discloses a microfluidic system above wherein a first pair of electrodes is arranged upstream or downstream of said segment of the microchannel, anywhere in microchannel or microfluidic system, and

wherein the second pair of electrodes is positioned on each side of said segment (Squire at Fig. 10).

As to claim 26, Squire in view of Takahashi discloses a microfluidic system above wherein the conducting means is a portion of the microchannel wall effecting a deflection of the local electrical field so that the field is inclined with respect to the conducting means (Squire at Fig. 14).

As to claim 27-31, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be used does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations (MPEP 2113). It is the examiner's position that the device of Squire would be capable of such use.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 1, 3-10, 12-21, 23-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Squires et al (2001).

As to claim 1, Squire discloses a microfluidic system comprising a substrate consisting of at least one microchannel (Fig. 14; Pg. 9, 2nd paragraph), and an electrical connection mean for application of an electric field (U) across a segment of said microchannel (Fig. 14, Pg. 9, 2nd paragraph), characterized in that said segment comprises conducting means (Fig. 14, Pg. 9, 2nd paragraph) wherein a surface portion of conducting means is inclined with respect to the electrical field, and the space between the different conducting means, and between the conducting means and the channel walls are both 0 a_{char} (while a_{char} is interpreted as between 0.05um – 2.5mm for the purpose of examination) thus 0 x a_{char} = 0 um/mm (Fig. 14, Pg. 9, 2nd paragraph) and the surface of the conducting means is smooth (metal surface) (Pg. 9, 1st Paragraph).

For the purpose of examination the surface irregularities are interpreted as less than 5% of d_{char} (d_{char} = 0.1um – 5mm) which is between 0.005um – 250um. Squire does not disclose that the surface irregularities of the conducting means are as interpreted as in claim 1.

For the purpose of providing less drag on the fluid flow across the conducting means and less fluid trapped within the mixer, it would have been obvious to one with ordinary skill in the art at the time of the invention to have the conducting means of Squire to have a smooth surface with irregularities between 0.005um – 250um, a smooth surface would provide less drag on the fluid flow across the pillars, thereby

encouraging more agitation of the fluid flow. In addition, smoother surfaces would be less likely to hold on to fluid being dispensed through the mixer and would be less likely to trap the analyte of interest as well as being less likely to exhibit memory effects from previous analytes should the mixer be utilized for subsequent analyses . Finding the desired smoothness, including the claimed smoothness ranges, to realize any or all of the above advantages of smooth surfaces would have required only routine skill in the art.

As to claim 3, Squire discloses a microfluidic system above, wherein the conducting means has the shape of cylinders (Squire at Pg. 3, 2nd paragraph).

As to claim 4, Squire discloses a microfluidic system above, wherein the conducting means consists of small cylinders with the longitudinal axis normal with respect to the fluid direction (Squire at Fig. 1 &2; Pg. 3, 2nd paragraph)

As to claim 5, Squire discloses a microfluidic system above, wherein the conducting means has the shape of particles with planes which are inclined with respect to the imposed electric field (Squire at Fig. 12).

As to claim 6, Squire discloses a microfluidic system above, wherein the particles constituting the conducting means have a size of 2um, measured in parallel to the externally imposed electric field (Squire at Fig. 1; a = 1um).

As to claim 7, Squire discloses a microfluidic system above, wherein the angle λ between the inclined surface portion and the microchannel walls is 0 degrees (Squire at Fig 7).

As to claim 8, Squire discloses a microfluidic system above, wherein the angle λ between the inclined surface portion and the microchannel walls is between 0-180 (Squire at Fig. 12; Pg. 8, 1st Paragraph). However, Squire does not disclose that the angle λ between the inclined surface portion and the microchannel walls is between 30-60 degrees. Where the claimed ranges lie inside or overlap ranges disclosed in the prior art a prime facie case of obviousness exists (MPEP 2144.05 [R-5]).

As to claim 9, Squire discloses a microfluidic system above wherein the conducting means contains several layers of conducting particles, both axially and longitudinally in relation to the flow direction (Squire at Fig. 13).

As to claim 10, Squire discloses a microfluidic system above wherein the conducting means consist of electron conducting material (Squire at Pg. 3, 1st paragraph).

As to claim 12, Squire discloses a microfluidic system above wherein the electrical connection means contains a pair of electrodes arranged upstream or downstream with respect to the microchannel segment (Squire at Fig. 7).

As to claim 13, Squire discloses a microfluidic system above wherein the electrical connection means is adapted to provide an electrical field (u) parallel to the direction of transported field (Squire at Fig. 9).

As to claims 14 – 20 and 25, Squire discloses a microfluidic system above wherein the electrical connection means applies an alternating field (Squire at Pg.5, 1st Paragraph). The remaining claim language is functional and it is the examiner's position

that the microfluidic system of Squire in view of Takahashi meets the structural limitations and would be capable of performing the claimed functions.

As to claim 21, Squire discloses a microfluidic system above wherein the electrical connection means applies a direct electric field (DC) (Squire at Pg3. 1st Paragraph).

As to claim 23, Squire discloses a microfluidic system above wherein electrical connection means contains four electrodes (Squire at Fig. 10). The remaining claim language is functional and it is the examiner's position that the microfluidic system of Squire meets the structural limitations in would be capable of performing the claimed functions.

As to claim 24, Squire in view of Takahashi discloses a microfluidic system above wherein a first pair of electrodes is arranged upstream or downstream of said segment of the microchannel, anywhere in microchannel or microfluidic system, and wherein the second pair of electrodes is positioned on each side of said segment (Squire at Fig. 10).

As to claim 26, Squire in view of Takahashi discloses a microfluidic system above wherein the conducting means is a portion of the microchannel wall effecting a deflection of the local electrical field so that the field is inclined with respect to the conducting means (Squire at Fig. 14).

As to claim 27-31, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be used does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations (MPEP

2113). It is the examiner's position that the device of Squire would be capable of such use.

8. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Squire et al as applied to claim 1 above, and further in view of Noca et al (US 6,685,810).

Squires discloses a microfluidic system in accordance with claim 1, wherein the microchannel comprises conducting means within the channel walls (Squire; Fig. 14, Pg. 9, 2nd paragraph) and the surface irregularities being less than 1% of d_{char} which is interpreted for the purpose of examination to be (d_{char} = 0.1um – 5mm) between 0.001um – 50um (Takahashi, Pg. 2, [0020]).

Squire does not disclose the space between the different conducting means, and between the conducting means and the channel walls to be between 1/8 a_{char} and 1/2 a_{char} wherein for the purpose of examination (a_{char} = 0.05um – 2.5mm) is interpreted as being between 6.25nm – 1.25mm.

Noca discloses a microfluidic system (40) comprising a substrate (42) having at least one microchannel, and an electrical connection mean for application of an electric field (56) across a segment (54) of said microchannel (Fig. 5; Column 10, lines 15-25), characterized in that said segment comprises conducting means (20) wherein a surface portion of conducting means is curved with respect to the electrical field (Fig.1; Column 6, lines 48-50), and the space between the different conducting means, and between the conducting means and the channel walls are to be between 1/8 a_{char} and 1/2 a_{char}

wherein for the purpose of examination (a_{char} = 0.05um – 2.5mm) is interpreted as being between 6.25nm – 1.25mm (Column 9, lines 30-32).

It would have been obvious to one with ordinary skill in the art at the time of the invention to have the space between the different conducting means, and between the conducting means and the channel walls of Squire in further view of Takahashi to be between 6.25nm – 1.25mm, as taught by Noca, and the surface irregularities being less than 1% of d_{char} (between 0.001um – 50um) (Takahashi, Pg. 2, [0020]). The spacing between conducting means and the channel walls can be optimized to allow specific fluid rate and mixing conditions.

9. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Squire et al as applied to claim 1 above, and further in view of Guinn et al (US 6,677,832) and Chow et al (US 6,149,787).

Squires discloses a microfluidic system in accordance with claim 1, wherein conducting means is metal (Squire at Pg. 9, 1st paragraph) and the said fluid can be any liquid electrolyte (Squire at Fig. 1).

Squire does not disclose the specific conductivity of the broad range of substances that fall within the group in order to find a relationship between them.

Guinn discloses a conductor made of metal (copper) with a conductivity of 5.8×10^7 S/m (Column 3, lines 49-50). The metal has a very high conductivity.

Chow discloses a high ionic strength fluid used within a microfluidic system which has a conductivity of 20 mS/m (Column 18, lines 43-48). The fluid has a very high conductivity.

It would have been obvious to one with ordinary skill in the art at the time of the invention to form the conducting means made up of copper and the liquid electrolyte made up of a high ionic strength fluid so that the conducting means of Squire in further view of Takahashi would have a conductivity of at least 5 times the conductivity of said fluid, as taught by Guinn and Chow, for the purpose of having the bulk current within the fluid directed towards the solid conductor to charge the diffuse layer more efficiently (Squire at Pg. 3, 2nd paragraph).

10. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Squire et al as applied to claim 1 above, and further in view of Zanzucchi et al (US 5,985,119).

Squires discloses a microfluidic system in accordance with claim 1 comprising of electrical conduction means and the conducting means.

Squires does not discloses that the distance between each electrical connection means and the conducting means is between 0.1um and 5mm.

Zanzuchhi discloses a microfluidic system comprising a substrate consisting of at least one microchannel (218) (Fig. 5), and an electrical connection mean (365) for application of an electric field across a segment of said microchannel (Fig. 2A), characterized in that said segment comprises conducting means (364) wherein a surface portion of conducting means is inclined with respect to the electrical field (Fig.

2A). Furthermore, Zanzuchhi discloses that the distance between each electrical connection means and the conducting means is between 0.1um and 5mm (Column 22, lines 44-47).

It would have been obvious to one with ordinary skill in the art at the time of the invention to make the distance between each electrical connection means and the conducting means of Squire in further view of Takahashi to be between 0.1um and 5mm, as taught by Zanzucchi, for the purpose of having optimizing the pumping technique in regards to the analyte used (Column 8, lines 54-59).

Contact / Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to HOSEIN KAFIMOSAVI whose telephone number is (571)270-5271. The examiner can normally be reached on Mon - Fri, 7:30 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on (571) 272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/H. K./
Examiner, Art Unit 4132

/Jessica L. Ward/
Supervisory Patent Examiner, Art Unit 4132